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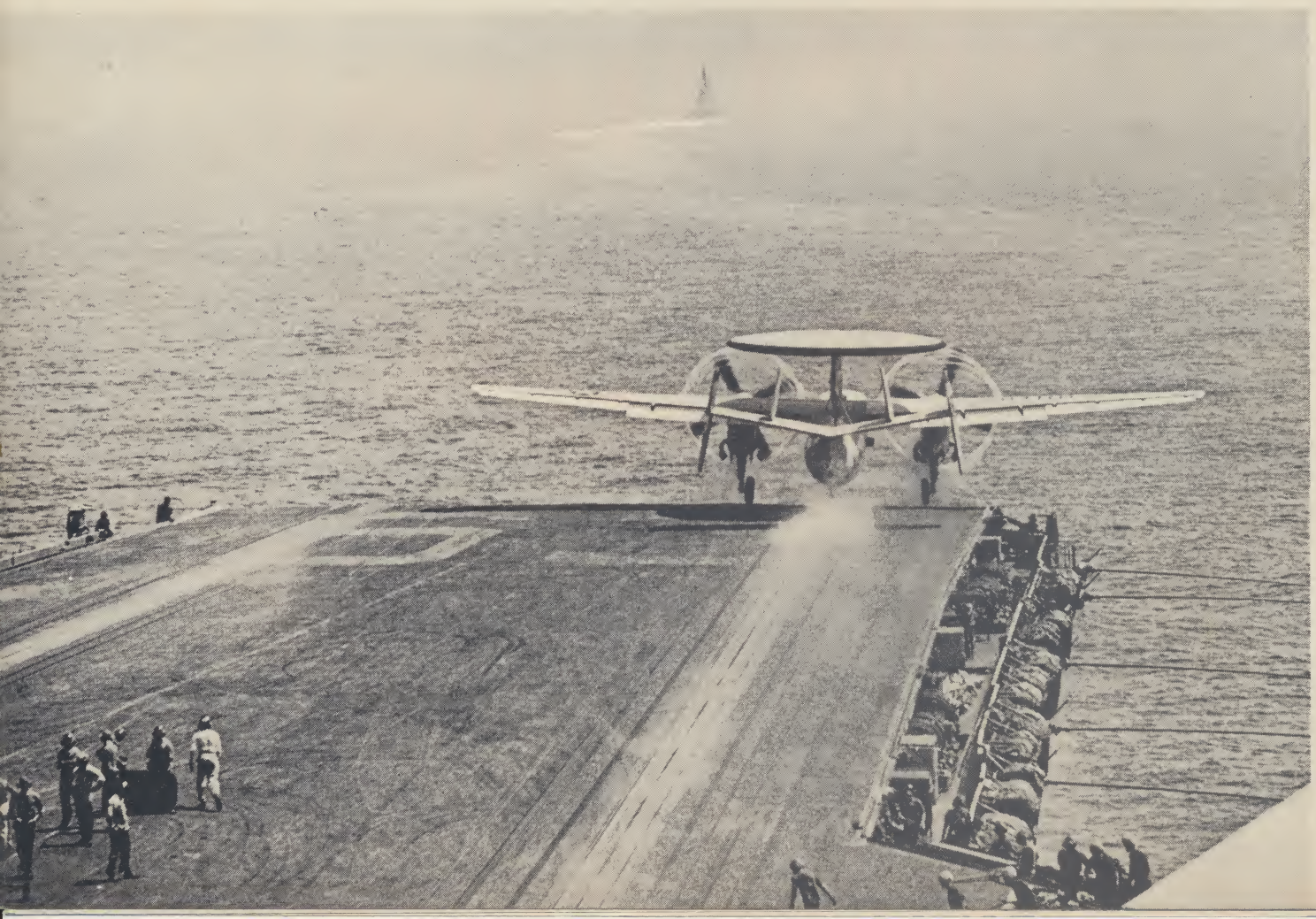
Grumman E-2As Monitor Navy Viet Air Strikes

ALOTS Photo Shows Saturn Shock Wave

WITH ENGINES AT FULL POWER, the pilot of a Navy/Grumman E-2A receives a signal (above) from the catapult officer that his aircraft is about to be launched from carrier USS Kitty Hawk off coast of North Vietnam. Steam catapult propels E-2A down deck (below) on a mission of directing Navy strikes on North Vietnamese targets. Crew, lower right, rushes to prepare another launch.



FIVE HOURS LATER, the E-2A makes its approach to the deck of the Kitty Hawk with its tail hook lowered. The aircraft carrier's four E-2As flew an average of more than 400 hr. per month while on station off North Vietnam.

E-2A Controls Navy North Vietnam Strikes

By Cecil Brownlow

Washington—Airborne tactical data system (ATDS) of the Grumman E-2A Hawkeye twin-turboprop early-warning aircraft now is being used to monitor and control virtually all Navy air strikes over North Vietnam. Working with the E-2A, Navy aircraft have been completing approximately 95% of their assigned sorties. Reliability of the complex ATDS system also has been high in the combat environment despite early problems in the development program of the system.

With the scant, spotty air opposition offered by the small North Vietnamese air force thus far, the E-2As have been used essentially as command and control centers for Navy strike aircraft since the arrival of the first detachment of four on the carrier USS Kitty Hawk late last year.

Essential functions being performed by the E-2A's three ATDS operators include:

• **Strike control.** One E-2A can handle 50-100 aircraft at any given time, with the operator vectoring the flight leader of each unit to the target area. In adverse weather, the ATDS operators can bring a flight of strike aircraft to within 1 mi. of its assigned target and on the proper heading, provided there is a ceiling of at least 300 ft. that will permit the aircraft to carry out the actual attack visually. Over North Vietnam, visual contact must be made to ensure that the target is an approved

TWO E-2As ARE PARKED on the deck of Kitty Hawk in the photo above. At the left are two Grumman A-6A Intruder aircraft used for night interdiction missions as well as serving as "pathfinders" to guide other aircraft to their targets.

KITTY HAWK E-2A, with wings folded, begins engine run-up before launch. Crewman in foreground signals that proper catapult settings have been made to compensate for wind and gross weight of aircraft. Douglas A-1H piston-engine strike aircraft is in right background.

one that may be struck under current White House ground rules.

In at least two instances this year, the E-2A has made it possible for strike aircraft to find and destroy bridges in weather conditions that otherwise would have resulted in aborted missions, according to Navy officials here. They add that the limitations imposed by weather now depend largely upon the capability of the aircraft to land on the carrier deck without undue risk rather than conditions in the target area. If the operators are familiar with the terrain over which the attack aircraft are operating, they also can provide terrain-avoidance information to the strike pilots.

SAM Avoidance

To avoid attack from Soviet-built SAM-2 surface-to-air missiles or anti-aircraft fire, the E-2As normally operate offshore at an altitude of about 25,000 ft. In this regard, data on the ATDS displays also are being used to vector strike aircraft around SAM sites as they penetrate North Vietnamese air space to reach the assigned target area.

• **MiG intercept information.** When the Russian-built MiGs of the North Vietnamese air force do take to the air, their flights are monitored by the E-2As. If the MiGs appear to be in a position to menace any of the U.S. strike flights, the E-2A will vector intercept aircraft into the area. The MiGs, however, appear to be equipped with some type of detection system that alerts their pilots that they are being monitored by radar. After being "painted," the aircraft tend to break for low altitude and wing their way back to home base through the valleys. Experience also has taught the ATDS operators to eliminate most ground and sea clutter from their scopes, making it possible for them to detect and track any enemy aircraft that might attempt a low-level attack against U.S. Navy ships in the Tonkin Gulf off North Vietnam.

• **"De-lousing."** IFF (information, friend or foe) equipment of each Navy strike aircraft is monitored as it leaves the target and begins the return to its carrier. This is to guard against any attempts by a Communist aircraft to try and make a "disguised" approach to the fleet units or slip up on the returning aircraft in an attempt to make a kill. If there is no IFF response from an aircraft, the pilots will be alerted to check their gear. If there still is no change in the display, an intercept may be ordered.

• **Surface surveillance.** The E-2A radars are used to monitor the junk and torpedo-boat activity off the North Vietnamese coast. If any suspicious activity is detected, Douglas A-1 piston-engine aircraft are vectored in for a strike.

• **Orientation.** If the pilot of an aircraft, Navy or Air Force, becomes disoriented after leaving the target, he can call for a position fix from the E-2A. The ATDS operators also alert an aircraft if it is straying towards the Communist Chinese border. Aircraft in need of air-to-air refueling also can be vectored to a tanker on station in the area.

• **Traffic control.** E-2A is used to maintain general traffic control in the strike areas as well as on the en route and return flights.

• **Rescue aid.** If a U.S. aircraft goes down over North Vietnam or in the Tonkin Gulf, its position is marked, and the E-2A vectors a helicopter or a Grumman HU-16 amphibious aircraft to attempt a rescue of the crew.

Mission Length

Normal length of an E-2A mission is approximately 5 hr., and the four aircraft of the Kitty Hawk flew over 400 hr./month while on station off North Vietnam. There were six flight crews for the squadron.

The ATDS, for which Grumman is the systems integration manager, essentially is an extension of the shipboard naval tactical data system (NTDS). The airborne display can be transmitted visually in whole or part by high fre-

quency (HF) radio to a NTDS on board a carrier or destroyer or to another E-2A. In evaluation tests, a display has been transmitted approximately 3,000 mi. from an E-2A flying over Long Island, N.Y., to another E-2A over Pt. Mugu, Calif. Information transmitted includes both classification and identification data of targets.

The ATDS consists of four basic components—the search radar, a detection computer, a larger digital computer indicator for tracking and intercept control plus data links for control of assigned aircraft, and communications with the monitoring NTDS. The antenna for the long-range radar is housed in a 24-ft.-dia. "rotodome" that rotates at a rate of 6 rpm.

The rotodome, which can be lowered for hangar-deck storage on the carrier, rests on a structure positioned above the high wing and aft fuselage section of the aircraft.

Data Processing

The radar scopes of the three operators receive computer-processed—or, if the operator prefers, raw—data from the aircraft's radar system as well as electronic inputs from the IFF equipment on board the strike aircraft. The video data are processed by the computer detector to determine whether the aircraft's IFF transponder is on and whether it is transmitting the proper code of the day. The video then is fed into the computer indicator for tracking and intercept data plus target correlation.

A total of 72 selections, including both data inputs and displays, also can be fed into the computers and, through them, to the scopes of the operators by the use of a series of selector buttons on the display panel. Broad categories include target classification and reporting, target height, target track numbers and target association. Symbology visually identifies a target as a friendly aircraft, an unknown, a hostile aircraft that does not present a threat to friendly forces or a hostile aircraft that does present a threat. By using the selector panel, the operator can assign track numbers to an aircraft through use of a data entry key board. If he wants to recheck the individual target, he flips a selector switch, and it is identified within seconds.

Target Signal

After the data have been fed into the computers and memory storage unit, an operator can "hook" a target signal with his electronic pencil and get an immediate read-out on the aircraft's position in miles, its altitude and category—friendly, unknown, etc. The display itself can be ground-stabilized to obtain a true orientation of the situation or air-stabilized so that the target blips are displayed relative to the operator's position. Generally, however, it is ground-stabilized for accuracy. This permits the aircraft to show the true track in all directions, and the display retains the same relative position vis-a-vis the targets being monitored.

Each operator has an individual set of controls and can select the presentation he wants. He also can mask out areas such as South Vietnam—where there sometimes is an intense U.S. air activity that is of no concern to the operator—that he does not want to monitor. The computers then will refuse to accept any signals from these areas. An aircraft in an area being monitored, however, can be acquired within seconds after its takeoff from the carrier. Major subsystems of the ATDS and related components carried by the E-2A include:

- **General Electric APS-96** radar.
- **Litton ASA-27** computer indicator group.
- **Litton ASN-36** inertial navigation system.
- **General Electric CP-413** computer detector.
- **Collins ASQ-52** data link system.
- **Dalmo Victor rotodome.**
- **Collins HF trail antenna** for extended range. Length of the antenna also can be adjusted to match the frequency being used.

Operator Arrangement

The three operators in the fuselage sit in a side-by-side arrangement facing the left side of the aircraft. The first operator currently is an enlisted avionics technician who carries out inflight trouble-shooting checks of the ATDS package. Reliability of the equipment has been such, however, that the Navy is planning to send the E-2A pilots and copilots through its combat intelligence center school at Glyncoe, Ga. When this has been accomplished, the copilot will go to the rear to function as a controller once the aircraft has arrived on station.

In this regard, a recent E-2A production contract awarded Grumman includes a reliability clause which stipulates that the firm must guarantee that the individual aircraft involved will remain mission-qualified for a specified number of hours. The company must demonstrate that an aircraft has met the guarantees before it receives full payment from the Navy.

The second, or middle, operator is the aircraft's combat intelligence center officer (C.I.C.) who has the decision-making responsibility on board the aircraft and carries out the instructions transmitted to him by his counterpart at the controlling NTDS. He normally is a qualified air controller.

The third position is occupied by the air control officer, who either directs or monitors the tactical strikes, leaving the C.I.C. officer free to make an over-all assessment of the situation as it unfolds. During a period of intense air activity, however, all three operators probably would become controllers.

The Navy expects the E-2A to remain in the active inventory through the late 1970s, and some down-the-road modifications may be made to the ATDS. Because of size considerations and the current state-of-the-art, for instance, the E-2A's inertial navigation system must work through the larger navigation unit of the controlling surface ship. The Navy would like to free the aircraft of this dependence, and, as the art of microminiaturization advances, steps in this direction may be taken, although development costs would be high.

Advanced Equipment

Litton also has proposed a more advanced computer indicator, but the Navy says that Grumman, as the systems integration manager, and Litton must demonstrate that it has a capability of attaining 1,000 hr. between overhaul before it will be accepted for incorporation into the ATDS.

Because of the stringent training requirements necessary for the ATDS maintenance personnel, the Navy would like to see the incorporation of more self-test capability in the equipment. Such a step also would ease the crowded flight-deck conditions on the carriers.

The Navy eventually plans to have an E-2A detachment on all of its large attack carriers, and the training times required for the airborne operators and the carrier-based maintenance personnel could present a bottleneck.

Maintenance Personnel

The first two detachments of ATDS maintenance personnel that have been trained thus far, as an example, received an initial indoctrination course at Grumman's Bethpage, L. I., plant and then spent an additional year in training at the E-2A squadron's home base on North Island, Calif.

Training of the airborne operators also is time-consuming. A C.I.C. officer who already has attended the Glyncoe school could be deployed after six months of training with the E-2A. The Navy, however, would prefer a full year of training, if possible.

Reliability and availability rate of the aircraft operating from the Kitty Hawk is about the same as that of the carrier's strike aircraft, according to Navy officials, but, because of its complexity, the E-2A requires the attention of approximately twice as many maintenance personnel per aircraft.

At present, about 50 maintenance man-hours are required for every hour of flight time.

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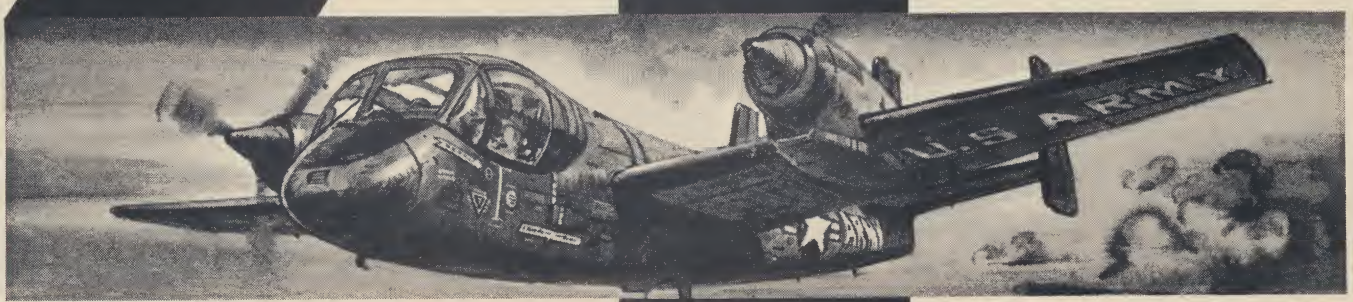

ARMY MOHAWK SETS

The United States Army and Grumman claimed four world aviation records in 1966 with the OV-1 Mohawk, reconnaissance and surveillance intelligence aircraft.

The Mohawk accomplished these records for turboprop aircraft weighing between 13,227 lbs. and 17,636 lbs.:

- Time to climb to 3,000 meters (9,842 ft.) 3 minutes and 46 seconds
- Time to climb to 6,000 meters (19,685 ft.) 9 minutes and 9 seconds
- Sustained altitude in horizontal flight, 32,000 ft. (Pilot: James Peters, Grumman)
- 100 KM closed-circuit course at 5,000 feet in 12 minutes 44.8 seconds, for average speed of 292 miles per hour (Pilot: Col. Edward Nielsen, U.S. Army)

NEW RECORDS

Other records are being set by the Army's Mohawks in day-in, night-out operations in SLAR, IR, photo and eyeball reconnaissance in Vietnam. Working as a team, the OV-1B SLAR and OV-1C Infrared Mohawks see what's ahead for the Army's assault groups in Vietnam. These aircraft play a vital part in identifying enemy installations and movements. Field commanders need this type of air-to-ground reporting to establish tactical superiority.

Pilots Colonel Edward L. Nielsen, USA, and James Peters, Grumman. In center NAA observer Ron Ellico.

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